CLAIMS

What is claimed is:

1. A composition of matter selectively permanently differentiable in regions by selective radiation illumination, the composition consisting essentially of

a monomer photopolymerizable to a polymer; and

a dye attaching the polymer;

wherein the dye both (i) migrates to, and (ii) is fixed in position at, regions photopolymerized by selective illumination with radiation.

2. The composition of matter according to claim 1 wherein the dye not only becomes (ii) fixed in position at photopolymerized regions, but chemically attaches the polymer at these regions.

3. The composition of matter according to claim 1 further consisting essentially of

a binder in which is present the (i) monomer photopolymerizable to a polymer being thus a photopolymer, and (ii) the dye.

4. The composition of matter according to claim 1

wherein the dye is fluorescent.

5. An initially homogeneous medium that is suitably selectively differentiated by selective exposure to radiation, the medium consisting essentially of

a binder; containing

a photopolymer, the photopolymer initially substantially homogeneously doped with

a dye that is photoexcitable to bind to photopolymer;

wherein upon selective exposure of certain regions of the medium by radiation, each of (i) polymerization, (ii) dye migration

and (iii) dye fixing will occur, the photopolymerization selectively progressively solidifying the photopolymer, while, simultaneously, dye molecules initially migrate to photopolymerized regions and are there fixed in position by the photopolymer;

wherein a concentration gradient of dye in the medium from unexposed to exposed regions results, this concentration gradient resulting from diffusion of the dye from unexposed to exposed areas;

wherein the initially homogeneous medium becomes selectively differentiated in that dye concentration is increased in exposed areas relative to unexposed areas.

6. The medium according to claim 5
wherein the dye is fluorescent.

7. The medium according to claim 5
wherein the dye is a photoinitiator of the photopolymerization.

8. The medium according to claim 5
wherein the dye is so fixed in position by the photopolymer by at least an action of chemically attaching the polymer.

9. The medium according to claim 8
wherein the dye chemically attaching the polymer does also chemically attach the monomer, making that it migrates in accompaniment to the attached monomer until, and where, the monomer does photopolymerize to a polymer.

10. A medium suitably selectively recorded by radiation consisting essentially of
a host matrix; containing
a liquid monomer, in which molecular mobilities are relatively higher, that is photopolymerized into a solid polymer in which

molecular mobilities are relatively lower, the monomer initially substantially homogeneously doped with

a dye that is photoexcitable to bind to at least the polymer;

wherein upon selective exposure of certain areas of the matrix by radiation, both (i) polymerization and (ii) dye fixing will occur, the monomer undergoing a polymerization process that solidifies the matrix, while, simultaneously, radiation-exposed and photoexcited dye molecules bind to at least polymer molecules;

wherein dye molecules photoexcited to bind to at least the polymer molecules become, due to the relatively lower molecular mobility in the polymer, relatively fixed in their location while other un-photexcited dye molecules remain relatively more mobile, resulting in an initial migration and redistribution of dye to photoexposed regions until, dye migration being substantially complete, photopolymerization occurs, locking the migrated dye in place at a relatively higher concentration at the selectively exposed regions;

wherein there is a concentration gradient of dye molecules in the material from the unexposed to the exposed areas, this concentration gradient resulting from diffusion of the dye from unexposed to exposed areas;

wherein dye concentration is increased in exposed areas relative to unexposed areas;

wherein after selective radiation exposure stops an excess concentration of dye molecules in the exposed areas serves as a record of the selective radiation exposure.

11. The medium according to claim 10

wherein the dye is photoexcitable to bind to the monomer as well as the polymer;

wherein initial migration and redistribution still transpires, with the dye and the monomer still photopolymerizing to dye and polymer more selectively pronouncedly in photoexcited, exposed areas.

12. The medium according to claim 10 further including

an inhibitor of the photopolymerization so that in regions of low radiation exposure polymerization is inhibited nonetheless that other regions where radiation is concentrated become fully polymerized.

13. The medium according to claim 12 wherein the inhibitor of the photopolymerization consists essentially of

oxygen.

14. The medium according to claim 10 wherein the host matrix consists essentially of

binder; and

solvent;

wherein the dye has a greater affinity for the photopolymer than for the binder and the solvent.

15. The medium according to claim 14 wherein the binder consists essentially of

cellulose acetate propionate;

and wherein the solvent consists essentially of

acetone.

16. The medium according to claim 10 wherein the photopolymer consists essentially of

a monomer;

a crosslinker;

an initiator; and

a photosensitizer.

17. The medium according to claim 16 wherein the monomer consists essentially of

dipentaerythritol pentaacrylate;

wherein the crosslinker consists essentially of
1-vinyl-2-pyrrolidinone;
wherein the initiator consists essentially of
N-phenyl glycine; and
wherein the photosensitizer consists essentially of
camphor quinone.

18. The medium according to claim 10 wherein the dye is drawn from the group consisting essentially of
Rhodamine B; and
Bodipy Red.

19. The medium according to claim 10
wherein the photopolymer is initially substantially uniformly doped with the dye.

20. The medium according to claim 10
wherein the dye is fluorescent.

21. The medium according to claim 20 selectively illuminated in regions to write and to store data as an optical memory, reading of the optical memory transpiring by inducing fluorescence of the dye.

22. The medium according to claim 21 wherein the selectively illuminated regions are voxels, the optical memory being a three-dimensional volume optical memory.

23. The medium according to claim 10 selectively illuminated in regions to write and to store data as an optical memory, reading of the optical memory transpiring by detecting relative presence or absence of the dye.

24. The medium according to claim 23 wherein the selectively illuminated regions are voxels, the optical memory being a three-

dimensional volume optical memory.

25. A method of radiatively recording information in a photosensitive medium, the method comprising:

establishing a host matrix containing a photopolymer that is polymerized by radiation initially substantially uniformly doped with a dye that photoinitiates photopolymerization;

selectively exposing selected regions of the matrix by radiation so that the dye migrates to redistribute itself to exposed regions until, dye migration being substantially complete, photopolymerization occurs, therein serving to lock the migrated dye in place at a relatively higher concentration at the selectively exposed regions;

wherein the regions where is present the dye represent the information recorded.

26. The method according to claim 25 wherein the recording of information is for the purpose of making a radiation memory, and wherein the method further comprises:

radiatively reading the radiation memory by radiatively detecting the relative presence, or absence, of the dye in the regions of the matrix.

27. The method according to claim 26 wherein the radiatively detecting of the relative presence, or absence, of the dye is by inducing fluorescence in the dye.

28. A writable radiation memory system comprising:

a first laser; illuminating with a first laser beam

a mask; which is imaged through

a 4-f lens system; to a certain depth within

a volume optical recording medium consisting essentially of

a host matrix, containing

a photopolymer that is polymerized by radiation, doped

with

a dye that photoinitiates photopolymerization;

wherein upon selective exposure by the first laser through the mask of certain regions of the matrix, the dye will initially migrate to redistribute itself to radiatively exposed regions until, dye migration being substantially complete, photopolymerization will occur, locking the migrated dye in place at a relatively higher concentration at the selectively exposed regions.

29. The writable radiation memory system according to claim 28 that, between the first laser and the mask, further comprises:

a rotating diffuser serving to break up the spatial coherence of the first laser beam and randomizing the diffraction image of the first laser beam along its propagation path except when it is in focus.

30. The writable radiation memory system according to claim 28 that, in the optical path of the first laser beam, further comprises:

a lens for bringing to a focus the first laser beam within the volume optical recording medium.

31. The writable radiation memory system according to claim 28 expanded and extended to reading, the read-write radiation memory system further comprising:

a shutter means for blocking the first laser beam;

a second laser for producing a second laser beam;

a lens for focusing the second laser beam onto selectively exposed regions of the matrix that are at a particular depth within the volume optical recording medium, causing the exposed regions to fluoresce; and

a detector of the fluorescence as representing the read contents of the volume optical recording medium, ergo a read-write

optical memory.

32. The read-write radiation memory system according to claim 31 wherein the lens comprises:

a cylindrical lens.

33. The read-write radiation memory system according to claim 30 wherein the detector comprises:

a CCD.